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(54) Title: DAIRY SPREAD AND METHOD OF MAKING A DAIRY SPREAD

(57) Abstract

A reduced–fat dairy spread which is spreadable at refrigeration temperatures has an appearance, flavour, consistency, rheology, and mouth–feel which is similar to conventional butter. The dairy spread has a formulation which comprises 20 % to 55 % by weight of butterfat, 30 % to 75 % by weight of water, 5 % to 30 % by weight of milk solids, and zero to trace amounts of each of a butter culture, salt, and approved butter colours which are compatible with butter, as well as zero to trace amounts of lecithin, potassium sorbate, sodium benzoate, and an acidifier. The soft but solid appearance, and refrigeration temperature spreadability, of the dairy spread are achieved as a consequence of protein coagulation at elevated temperatures of a stirred mixture of the starting materials. The liquid starting materials, heavy cream or milk, are unhomogenized; homogenization of the mixture does not occur until after protein coagulation at elevated temperatures has taken place. When the reduced–fat dairy spread is made, the water content is bound by the protein constituents of the milk solids, and is in a continuous phase dispersion. On the other hand, the butterfat is in a discontinuous phase, suspended in the continuous phase dispersion.

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DAIRY SPREAD AND METHOD OF MAKING A DAIRY SPREAD

FIELD OF THE INVENTION

The present invention is directed towards dairy spreads which are spreadable at low temperatures. More particularly, the present invention is directed towards dairy spreads which have essentially the same ingredients as ordinary butter, which have the same general appearance and consistency as butter, and which will be used for the same general purposes as butter, except for frying. The dairy spreads of the present invention are spreadable when removed from the refrigerator; in other words, the dairy spreads of the present invention are spreadable at refrigeration temperatures, usually just above freezing temperature in the range of about 2°C or 3°C to about 8° or 10°C.

An ancillary purpose of the present invention, and a corollary to the refrigeration temperature spreadability, is that dairy spreads in keeping with the present invention have a reduced fat and a lower caloric content than ordinary butter, and thus they have a lower cholesterol content or at least lower cholesterol inducing characteristics than ordinary butter.

BACKGROUND OF THE INVENTION

Ordinary butter has been known for centuries, and is used for a variety of purposes. One of the principal purposes for butter is to be spread on bread, rolls, buns, and the like, in order to increase palatability of the bread products, and for flavour. Butter also has a number of other purposes, and is a typical ingredient in many baked products; it may be placed on cooked vegetables and the like; and it may be heated in a frying pan for purposes of frying other foods. However, butter must be refrigerated, usually at temperatures just above freezing below about 8°C or 10°C; and when butter is removed from the refrigerator for use, especially so as to be spread on bread products of any sort, it is not spreadable. Prolonged storage of butter at room temperature, even in small quantities, improves the spreadability of the butter but leads to spoilage thereof. Also, in some jurisdictions, in order to qualify for the designation

of "butter", the product must be a churned dairy product which must be produced from chilled dairy cream, and must have at least 80% by weight butterfat content. Moreover, especially in modern times when much greater attention is being paid to what people eat, many people are concerned about the high fat content of butter

While the consumption of butter has decreased over the last number of years - per-capita butter consumption in the United States has decreased from 2.5 kilograms in 1970 to 1.9 kilograms in 1993 - many people still prefer to eat and use butter rather than margarine. It appears that many people consider margarine to be a highly manufactured, chemical product; and some people object to the flavour or lack of flavour, the greasiness, or other characteristics of margarine which distinguish it from butter.

However, particularly as a consequence of the lack of spreadability of butter when it is first removed from the refrigerator, and since the principal use of butter or margarine is to be spread on bread or other bread products, the margarine industry has remained a growth industry.

In some respects, the dairy industry has attempted to regain market share by providing spreadable butter-like compositions which have a number of the same constituents as butter, but which may be spreadable at refrigeration temperatures in the same manner that margarine is spreadable at refrigeration temperatures. For example, AHMED *et al*, United States Patent 4,769,255, provides a butter-like composition which is produced by phase reversal of an oil-in-water emulsion, having about 40% fat content, so as to become a predominantly water-in-oil emulsion, where the water is in a discontinuous phase and the oil is in a continuous phase. Because the ratio of water-in-oil emulsion to oil-in-water emulsion must be in the range of 6:4 to 9:1, the product tends to become unstable. Also, as noted, the AHMED *et al* product retains a relatively high fat content of about 40%.

Two other United States Patents, also issued to AHMED *et al*, are United States Patent 4,961,950, where the total fat content of the composition is at least 30%; and United States Patent 4,970,087, where the product is a mixture of water-in-oil emulsion and oil-in-water emulsion where the ratio of the emulsions is 6:4 to 8.5:1, and

the composition is dispensable from a manually-operated squeezable container, much the same as mustard, ketchup, or toothpaste.

FACKRELL *et al* United States Patent 5,487,913 teaches a reduced fat content butter product which is an emulsion of a liquid in a fat, to which lecithin and/or a stabilizer may be added.

One of the features of most low calorie, spreadable products that are presently available is that they will contain emulsifiers such as mono-di-glycerides, polysorbates, certain other gums or colloid ingredients, or starches. Margarines may also comprise a number of such ingredients. Thus, margarines and prior art low fat, butter-based spreadable products are highly manufactured, and may contain ingredients other than dairy products or the only other non-dairy products which are permissable in butter, namely salt, butter culture and approved butter colours.

The present invention, on the other hand, provides dairy spreads which are spreadable at low temperatures, which have a lower butterfat content and caloric content than ordinary butter, but which contain only the same ingredients as conventional butter. However, the dairy spreads of the present invention may also comprise certain permitted emulsifiers and preservatives.

Butter is a water-in-oil emulsion where the fat content is in a continuous phase. Since butter comprises 80% by weight butterfat, the lipid phase of butter is essentially solidified at refrigeration temperatures, and does not liquify or soften until it has been removed from the refrigerator and permitted to warm up towards room temperature. Margarines, of course, provide for spreadability at refrigeration temperature by using oils having lower melting curves, but those oils are not derived from dairy products. Most of the low calorie, spreadable butter-like compositions described above contain additional ingredients, and/or are highly manufactured beyond those which are expected from conventional butter.

The present invention, on the other hand, contains essentially the same ingredients as conventional butter, and as such it is properly termed to be a dairy spread. The spreadability of the dairy spread of the present invention, at refrigeration temperatures, comes as a consequence of the water binding properties of binding

constituents in milk solids, including protein coagulation. It is also noted that the dairy spread of the present invention displays the properties of a continuous water phase and a discontinuous fat phase, which contribute to the spreadability since the fat phase is distributed throughout the product, and is unagglomerated.

The present inventors have unexpectedly discovered that the water content of a dairy spread in keeping with the present invention can be bound by the binding constituents thereof, including protein constituents, so as to provide a stable product which can serve most of the purposes for which butter is used, while remaining in a continuous phase throughout the dairy spread product. However, the dairy spread product of the present invention has a lower fat and calorie content than conventional butter, and yet it is spreadable at refrigeration temperatures. By use of the term "reduced-fat" it is intended to mean less butterfat than ordinary butter which usually has a butterfat content of 80% by weight.

Indeed, at least one of the purposes of this invention is to provide a reduced-fat dairy spread which is spreadable at refrigeration temperatures. Preferably the dairy spread has an appearance, flavour, consistency, rheology and mouth-feel similar to butter. In its broadest sense, the dairy spread of the present invention has a formulation such that it may comprise from about 20% to about 55% by weight of butterfat, from 30% up to 75% by weight of water, from 5% up to 30% by weight of milk solids, and from zero up to trace amounts of any of a butter culture, salt and approved butter colours which are done compatible with butter, and combinations thereof. Typical approved butter colours include annatto colours and beta carotene, which are generally accepted and approved as colouring agents for butter, in most jurisdictions.

Moreover, the dairy spreads of the present invention may also comprise from zero up to trace amounts of lecithin, and preservatives such as potassium sorbate, sodium benzoate, and an acidifier such as citric acid or lemon juice. However, preferably, there are no added lecithin, preservatives or acidifier in the dairy spreads of this invention.

The reduced-fat dairy spread of the present invention is such that the water content thereof is bound by the protein constituents of the milk solids, and remains in a continuous phase dispersion throughout the dairy spread product. Moreover, the fat constituent of the dairy spread is in a discontinuous phase, suspended in the continuous phase dispersion of the water.

Thus, the present invention provides a dairy spread which, while not capable of being labelled and marketed as conventional butter in most jurisdictions, may be labelled as containing only the same constituents as conventional butter; or, at least, as containing the same constituents as butter together with permitted additives and preservatives. Moreover, the present invention provides a range of low fat options, whereby the dairy spread can be produced having from about 20% up to about 55% by weight of fat content. Moreover, when the dairy spread has a fat content of about 40%, $\pm$ 3%, that fact can be emphasized because such dairy spread has only one half the fat content of conventional butter.

The caloric content, by weight, of dairy fat compared with protein, lactose, or complex carbohydrates - all of the sort which derive from milk and which comprise the milk solids used in the present invention - is generally in the range of about 9:4. Thus, a dairy spread having about 40% fat content, in keeping with the present invention, would have slightly more than one half the calories per unit weight of conventional butter. It follows that a dairy spread having a fat content in the order of about 32% by weight would have about one half the calories per unit weight of conventional butter, while still having essentially the same appearance, flavour, consistency, rheology, and mouth-feel of conventional butter.

Reduced-fat dairy spreads in keeping with the present invention can be utilized for most of the same purposes as conventional butter, with the exception that they are not suitable for frying.

Accordingly, in one of its broad aspects, the present invention provides a dairy spread which is spreadable at refrigeration temperatures comprising:

butterfat in a range of about 20% to 55% by weight of the spread;

water in the range of about 30% to 75% by weight of the spread;

milk solids having binding constituents, wherein the milk solids are in a range of about 5% to 30% by weight of the spread;

wherein the milk solids are dissolved in the water and the binding constituents of the milk solids bind at least some of the water; and

wherein the water is in a continuous phase and the butterfat is in a discontinuous phase suspended in the continuous phase of water.

Also, in another of its broad aspects, the present invention resides in providing a method for producing dairy spread which is spreadable at refrigeration temperatures, the dairy spread comprising:

butterfat in a range of about 20% to 55% by weight of the spreads as described above, the method comprising the steps of:

a) providing a quantity of milk and/or cream having butterfat;

b) if the butterfat of the spread is not within the range of 20% to 55% by weight, adjusting the butterfat of the spread by adding butterfat to the milk and/or cream so as to bring the butterfat of the spread to within the range of about 20% to 55% by weight;

c) adding milk solids to the milk and/or cream, either before or after adjusting the butterfat, to form a mixture;

d) heating the mixture at a pasteurization temperature for a pasteurization time; and

e) wherein when the butterfat is present in globules having various sizes, modifying the size of the butterfat globules such that the butterfat globules are of approximate uniform size.

In another narrower aspect, the invention resides in providing a reduced-fat dairy spread which is spreadable at refrigeration temperature, and which has a preferred formulation comprising from about 20% to 43% by weight of butterfat, from 35% to 75% by weight of water, from 5% up to 30% by weight of milk solids, with zero to trace amounts of each of a butter culture, salt, and approved butter colours which are compatible with butter, and zero to trace amounts of lecithin (as an emulsifier), potassium sorbate, sodium benzoate, and acidifier. The water content of

the dairy spread is bound by the protein constituents of the milk solids, in a continuous phase dispersion thereof.

Further aspects of the invention will become apparent upon reading the following detailed description which illustrates the invention and preferred embodiments of the invention.

DETAILED DESCRIPTION OF THE INVENTION

The reduced-fat dairy spread, and the process for its production, have been described above in general terms. What follows are more particular comments which provide a more specific understanding of certain aspects of the invention, particularly in light of the fact that dairy spreads in keeping with the present invention cover a relatively broad spectrum of fat contents from about 20% butterfat up to about 55% butterfat content. As noted, at 40% $\pm$ 3% butterfat content, a dairy spread product is presented which is very similar to conventional butter - except that it is generally stored in plastic tubs, due to its consistency and the fact that it is spreadable at refrigeration temperatures and is, therefore, not adaptable to being wrapped with foil or parchment paper wrappers in the same manner as conventional butter. However, dairy spreads having about 40% $\pm$ 3% by weight of butterfat content have, by definition, only one-half the butterfat content of conventional butter.

As noted, dairy spreads in keeping with the present invention comprise only constituents which are derived from milk and/or cream, or acceptable additives which may be found in conventional butter - including butter culture, salt, and approved butter colours which are compatible with butter, and lecithin, potassium sorbate, sodium benzoate, and an acidifier. Thus it may be possible that dairy spreads in keeping with the present invention may be labelled in most jurisdictions in the same manner as butter, except for a statement as to their butterfat content and additional emulsifier and preservatives, if included.

In a preferred embodiment of the invention, no lecithin, emulsifier or a stabilizer is additionally added to the spread.

In a preferred embodiment of the invention, the water in the spread is a water phase of cream (cream in this sense would also include milk). In other words, the water in the spread is derived from cream or milk, and not additionally added.

One method for production of some of the reduced-fat dairy spreads of the present invention comprises the following steps:

a) A quantity of unhomogenized milk, unhomogenized heavy cream, and mixtures thereof, is selected; and that selected quantity of unhomogenized milk, unhomogenized heavy cream, or mixture thereof, may have a butterfat content of from about 20% up to 55%, and preferably 40% $\pm$ 3% by weight thereof. The unhomogenized heavy cream may or may not have been cultured before its use, by the addition of butter cultures thereto;

b) Butterfat is added, if necessary, to the selected quantity of unhomogenized milk, unhomogenized heavy cream, or mixture thereof, so as to bring the fat content thereof to a selected butterfat content which may be in the range of about 20% to 55%, and preferably 40% $\pm$ 3% by weight thereof;

c) The unhomogenized milk, unhomogenized heavy cream, or mixture thereof, is maintained at a temperature of about 2°C to 10°C, and a selected quantity of milk solids is added thereto so as to bring the milk solids content of the finished product up to about 5% to 30% by weight thereof;

d) While maintaining the unhomogenized milk, unhomogenized heavy cream, or mixture thereof, at temperature of about 2°C to 10°C, trace amounts of each of a butter culture, salt, and approved butter colours that are compatible with butter, may optionally be added to the unhomogenized milk, unhomogenized heavy cream, or mixture thereof. At the same time, any of the other optional trace amount ingredients - lecithin, potassium, sorbate, sodium benzoate, and an acidifier - may be added to the unhomogenized milk, unhomogenized heavy cream, or mixture thereof;

e) The mixture of unhomogenized milk, unhomogenized heavy cream, or mixture thereof together with the milk solids and optional trace constituents, is stirred while still maintaining the temperature of that mixture at about 2°C to

10°C, until a slurry is developed with the milk solids and the optional added trace constituents being held in suspension in the stirred mixture;

f) Then, the stirred mixture is heated to a temperature of about 82°C to 90°C, and is maintained at a temperature of about 82°C to 90°C for a period of from 25 seconds up to 6 hours, so as to permit coagulation of the binding constituents, including protein constituents, of the milk solids;

g) The heated stirred mixture is then homogenized at a temperature of about 25°C to 90°C;

h) The homogenized mixture is then transferred to a temperature controlled holding tank, where the temperature thereof is maintained at about 15°C to 40°C;

i) Then, the cooled homogenized mixture is transferred from the holding tank through a heat exchanger to a filling machine; and the temperature of the homogenized mixture is reduced to 8°C to 30°C;

j) Selected quantities of the cooled homogenized mixture are then transferred to containers, such as plastic tubs or the like, for storage as reduced-fat dairy spread; and

k) Finally, the reduced-fat dairy spread is stored at temperatures below 8°C.

The present invention is different than the prior art at least in that milk solids, preferably dry milk solids, are added to milk or cream, and preferably unhomogenized milk or cream, or a mixture thereof, at a temperature in the range of about 2°C to 15°C, and preferably less than 10°C, and then stirred until a slurry is developed by which the milk solids are dissolved in the water content of the milk/cream and held in suspension within the slurry, and then the slurry or mixture is heated to a temperature in the range of about 80°C to 90°C, and preferably above 82°C, and held at that elevated temperature for a period of time. The binding constituents, including protein constituents, of the milk solids in the slurry will coagulate and will develop and demonstrate a profound water-binding property or capability. The water-binding property may be as much as from one and two weight units and up to seven to ten

weight units of water being bound by one weight unit of binding constituent. In other words, the water will be bound by the milk solids. Moreover, the water will be found in a continuous phase.

On the other hand, whatever fat globules there may be in the slurry will be distributed throughout the slurry in a discontinuous phase.

The slurry can then be homogenized (to have the butterfat globules in the slurry modified to obtain a uniform size of the butterfat globules) at a slightly lower temperature, so as to obtain uniformity of particle size and dispersion of fat and bound water throughout the slurry. The "homogenizing" step can take place at temperatures in the range of about 25°C to up to about 90°C. Still further, and in any event as noted above, the fat is in a discontinuous phase, and the water is in a continuous phase - notwithstanding that it is bound by the binding constituents that are within the dairy spread.

Thereafter, the temperature of the homogenized slurry can be reduced and the homogenized slurry can be maintained at a reduced temperature until such time as quantities thereof are dispensed into containers from a filling machine, where the homogenized chilled slurry has by that time been reduced essentially to refrigeration temperature; and thereafter, the dispensed product in its containers can be stored as reduced-fat dairy spread.

It has been noted, of course, that at an appropriate time during the process for production of reduced-fat dairy spreads according to the present invention - preferably while the initial mixture remains cooled and prior to the step of stirring the mixture to develop a slurry - additional approved butter additives such as a butter culture, salt, or approved butter colours which are compatible with butter, may be added to the mixture. Moreover, other additional approved additives such as lecithin, potassium sorbate, sodium benzoate, or an acidifier may be added at that stage. The mixture remains unhomogenized.

All of the machines in which the various steps of the process according to the present invention may be carried out are ones which would normally be found in a conventional bulk milk handling and packaging facility - typically, a commercial dairy

- where packaged milk products are prepared for the market. For example, appropriate tanks, as may be required, will be found in a conventional milk handling and packaging facility, or commercial dairy; and such tanks will be located and associated with temperature controls or in a temperature controlled rooms so that the contents of the tanks may be held at whatever temperature is required to be for the particular step being undertaken.

Likewise, the tanks and necessary equipment to heat a stirred mixture up to a temperature of 80°C to 90°C and maintain the stirred mixture at that temperature for a sufficient period of time to permit coagulation of the binding constituents of the milk solids, will be found in an ordinary commercial bulk milk handling and packaging facility. Still further, homogenizing equipment will be found in such a bulk milk handling and packaging facility.

It should be noted that the step of heating a stirred mixture to a temperature of 80°C to 90°C and maintaining the heated mixture at that temperature for a period of time, will serve two purposes. First, the stirred mixture will be pasteurized. Also, maintaining the stirred mixture at that temperature for a period of time will permit coagulation of the binding constituents of the milk solids, and thus it will develop the water-binding property of the binding constituents. The period of time may vary from a matter of few seconds up to several hours. The length of time will depend on a number of factors, including the temperature at which the coagulation step is to be carried out, and the volume of heated stirred mixture which is being handled at that time. Typically, a batch will undergo protein coagulation at about 90°C in a matter of 10 to 30 seconds, but it may take as much as 60 seconds - or up to 6 hours or more at 82°C.

It is important to note that the heated stirred mixture must be heated to a temperature of at least about 72°C so as to ensure that the butterfat content thereof has completely liquified and that there are no fat crystals or fat crystal nuclei in the mixture. However, the present invention requires that the heating step be such that the slurry is heated to at least 80°C, and preferably 82°C, so as to assure that the requisite protein coagulation has taken place. Moreover, the heated stirred mixture should not

be heated above about 90°C, so as to preclude any risk of localized boiling of the water content of the mixture, and so as to preclude the likelihood of scorching of any of the milk solids.

The step of homogenization is carried out in equipment of the sort which will be found in most commercial bulk milk handling and packaging facilities. However, the mixture which is being homogenized may have varying butterfat contents, up to about 55%, and preferably 40% $\pm$ 3%, by weight, rather than the typical bulk milk or dairy cream butterfat contents of 1% up to about 15% to 20% by weight.

In general, the heat exchanger through which the homogenized mixture is transferred from a temperature controlled holding tank to a filling machine, is a swept surface heat exchange unit which, once again, is of the type which is generally found in a commercial bulk milk handling and packaging facility.

The finished product, as it is transferred to the containers in which it will be stored and sold - usually, plastic container tubs or the sort in which margarine, soft processed cream cheese, processed sour cream, cottage cheese, and the like, are sold - will thus be a product that has substantially the same rheology or consistency of margarine or the prior art manufactured butter-type spreads. However, as noted, the packaged dairy spread of the present invention will have a reduced-fat and reduced-calorie content compared to conventional butter.

Typical starting materials for the milk fat or butterfat contribution preferably include unhomogenized heavy cream, unhomogenized milk and butterfat, if necessary. The unhomogenized milk or unhomogenized heavy cream will contribute the required water content; there will be milk solids contributed from the unhomogenized milk or unhomogenized cream; and as well, preferably dry milk solids which may be dry skim milk solids, dry buttermilk solids, dry casein solids, dry caseinates, dry whey protein solids, and mixtures thereof, may be employed.

However, the fat content of the dairy spread according to the present invention may vary, and may be as high as about 55% by weight, or as little as about 20%, the starting material will be preferably an appropriate unhomogenized milk,

unhomogenized cream, or mixture thereof, having a predetermined butterfat content which is contingent upon the desired butterfat content of the finished product.

Again, it is noted that there is no substantial change in the amount of any of the constituents that are used in the production of dairy spreads in keeping with the present invention, once they have been mixed together in their intended quantities; and the physical appearance of a soft dairy spread which is spreadable at refrigeration temperatures for any specific starting materials, comes about particularly as a consequence of the coagulation of the binding constituents, including proteins, of the heated stirred mixture thereof.

A general formulation for the reduced-fat dairy spreads of the present invention is as follows, where the amount of any constituent is expressed in terms per cent by weight:

TABLE I:

water	30% - 75%
milk solids	5% - 30%
butterfat	20% - 55%
salt	0 - 2%
potassium sorbate	0 - 0.15%
sodium benzoate	0 - 0.15%
acidifier	0 - 0.15%
lecithin	0 - 0.60%
butter flavour or butter culture	0 - 0.35%
butter colour	0 - 0.03%

A typical general formulation for ultra-lite spreads, being dairy spreads which have from very minimal butterfat content up to 30% butterfat content, would be as follows, where the amount of any constituent is expressed in terms of per cent by weight:

TABLE II:

water	35% - 75%
milk solids	5% - 30%
butterfat	20% - 30%
salt	0 - 2%
potassium sorbate	0 - 0.15%

sodium benzoate	0 - 0.15%
acidifier	0 - 0.15%
lecithin	0 - 0.60%
butter flavour or butter culture	0 - 0.35%
butter colour	0 - 0.03%

Likewise, a typical formulation for a light dairy spread, having 30% to 43% by weight of butterfat, would be as follows, where the amount of any constituent is expressed in terms of per cent by weight:

TABLE III:

water	35% - 60%
milk solids	5% - 20%
butterfat	30% - 43%
salt	0 - 2%
potassium sorbate	0 - 0.15%
sodium benzoate	0 - 0.15%
acidifier	0 - 0.15%
lecithin	0 - 0.60%
butter flavour or butter culture	0 - 0.35%
butter colour	0 - 0.03%

There are two, more specific, embodiments of the present invention, by which reduced-fat dairy spreads having somewhat differing fat contents may be produced. Specifically, in a typical embodiment of the present invention where the dairy spread has about 30% to 43% by weight of butterfat, it will have 35% to 60% by weight of water content, from 5% to 20% by weight of milk solids, and zero to trace amounts of any of butter culture, salt, approved butter colours, lecithin, potassium sorbate, sodium benzoate, and an acidifier. The method for production of that particular reduced-fat dairy spread in keeping with the present invention usually provides for the selection of a quantity of unhomogenized heavy cream, which may have a fat content in the range of 40% by weight thereof. The remaining steps are essentially as discussed above.

Likewise, a lower fat reduced-fat dairy spread may have a butterfat content of about 20% to only about 30%, with 35% to 75% by weight of water, 5% to 30% by

weight of milk solids, and zero to trace amounts of any of butter culture, salt, approved butter colours, lecithin, potassium sorbate, sodium benzoate, and an acidifier. If so, that dairy spread may be manufactured from unhomogenized milk or mixtures or unhomogenized milk and unhomogenized cream, which in any event may be standardized to a butterfat content of zero up to 30% by weight thereof. The remaining steps for production are essentially as described above.

It is noted that, the firmness, but spreadability, of the dairy spread comes as a consequence of protein coagulation of the binding constituents of the dry milk solids which are part of the formulation, at temperatures above about 80°C preferably above 82°C, so as to develop an excellent water binding property of the coagulated binding constituent, including proteins. Thus, the water remains within the dairy spread as a continuous phase, and the fat content is a discontinuous phase.

The dry milk solids which are used in keeping with the present invention may be dried skim milk solids, dry butter milk solids, dry casein solids, dry caseinates, dry whey protein solids, and mixtures thereof. All of those milk solids are proteins, lactoses, or other complex carbohydrates, and all are derived from milk.

In a preferred embodiment of the invention, the dairy spread is spreadable at refrigeration temperatures (typically in the range of about 2°C or 3°C to about 8°C to 10°C) and the dairy spread has butterfat in the range of about 20% to 55% by weight of the spread;

water in the range of about 30% to 75% by weight of the spread;

milk solids having binding constituents, wherein the milk solids are in the range of about 5% to 30% by weight of the spread;

wherein the milk solids are dissolved in the water and the binding constituents of the milk solids bind at least some of the water; and

wherein the water is in a continuous phase and the butterfat is in a discontinuous phase suspended in the continuous phase of water.

In a more preferred embodiment of the invention. the water of the dairy spread is in the range of about 35% to 60% by weight; and in an even more preferred embodiment, the water is in the range of about 40% to 50% by weight.

In a preferred embodiment of the invention, the dairy spread has milk solids in the range of about 5% to 20% by weight; and in an even more preferred embodiment, the milk solids are in the range of about 10% to 17% by weight.

In a preferred embodiment of the invention, the butterfat of the spread is in the range of about 25% to 45% by weight and the milk solids are in the range of about 5% to 20% by weight.

In another preferred embodiment, the dairy spread has butterfat which is in the range of about 35% to 55% by weight and the milk solids are in the range of about 5% to 20% by weight.

In another preferred embodiment, the dairy spread has butterfat in the range of about 35% to 45% by weight and the milk solids are in the range of about 5% to 20% by weight.

In another preferred embodiment, the dairy spread has butterfat in the range of about 37% to 43% by weight and the milk solids are in a range of about 5% to 20% by weight.

In another preferred embodiment, the dairy spread has butterfat in the range of about 35% to 45% by weight, the water in the range of about 40% to 50% by weight, and the milk solids are in the range of about 10% to 17% by weight.

In a more preferred embodiment of the invention, the dairy spread has butterfat in the range of about 37% to 43% by weight, the water is in a range of about 40% to 50% by weight, and the milk solids are in a range of about 10% to 17% by weight.

In a preferred embodiment of the invention, no lecithin, emulsifier or stabilizer is additionally added to the spread.

A preferred method for producing the dairy spreads as described above has the steps of:

a) providing a quantity of milk and/or cream having butterfat;

b) if the butterfat of the spread is not within the range of 20% to 55% by weight, adjusting the butterfat of the spread by adding butterfat to the milk and/or cream so as to bring the butterfat of the spread to within the range of about 20% to 55% by weight;

c) adding milk solids to the milk and/or cream, either before or after adjusting the butterfat, to form a mixture;

d) heating the mixture at a pasteurization temperature for a pasteurization time; and

e) wherein when the butterfat is present in globules having various sizes, modifying the size of the butterfat globules such that the butterfat globules are of approximate uniform size.

Preferably, the quantity of milk and/or cream provided in step a) above is unhomogenized and/or unhomogenized cream.

Preferably, the milk solids are added to the milk and/or cream when the milk and/or cream is at a temperature in the range of about 2°C to 15°C.

Preferably, the mixture is allowed to hydrate at a suitable hydrating temperature before heating the mixture to the pasteurization temperature.

Preferably, the mixture is heated to a pasteurization temperature within the range of about 80°C to 90°C and maintained at that temperature for a period of about 25 seconds to 6 hours so as to pasteurize the mixture and so as to permit coagulation of the binding constituents of the milk solids.

In a most preferred embodiment of the invention, the mixture is heated to a pasteurization temperature of about 80°C for about 5 minutes.

In a preferred embodiment of the invention, the modification of the particle size of the butterfat globules takes place by "homogenization" when the mixture is at a temperature within the range of about 25°C to 90°C.

In a preferred embodiment of the invention the modification of the particle size of the butterfat globules takes place when the mixture is at a temperature within a range of about 55°C to 65°C.

In a most preferred embodiment of the invention, the quantity of milk and/or cream provided in step a) above is unhomogenized milk and/or unhomogenized cream;

the milk solids are added to the milk and/or cream when the milk and/or cream is at a temperature in a range from about 2°C to 15°C;

the mixture is allowed to hydrate at a suitable hydrating temperature before heating the mixture to pasteurization temperatures;

the mixture is heated to a pasteurization temperature of about 80°C for about 5 minutes; and

the modification of the particle size of the butterfat globules takes place when the mixture is a temperature within the range of about 55°C to 65°C.

In a preferred embodiment of the invention, at least part of the milk and/or cream which is provided has been cultured prior to its use.

Example

An example of a dairy spread made in accordance with the invention is described specifically below. A sample size of about 10 kilograms was prepared in which the final spread had a butterfat, or milk fat, content of about 40%, water about 45%, milk solids about 13%, salt about 1.2% and preservatives, specifically potassium sorbate, of about 0.1%, together with some beta carotene.

In the example, 82.3% of the total formulation by weight was cream having about 40% butterfat. One half of this cream was cultured for about 16 to 20 hours at about 20/21°C to reach a pH of about 4.9 to 5.2.

The milk solids comprising condensed dry skim milk and dry butter milk solids were added to the half of the cream which was not cultured. The milk solids were added when the cream was at a temperature of about 10°C.

After the milk solids were added the cream and milk solids mixture was heated to about 50°C. The mixture was allowed to hydrate at about 50°C for about 20 minutes.

When the mixture was about 50°C, about 0.8 kilograms of unsalted butter having a butterfat content of about 81% was added. Also, the trace amounts of the other ingredients as described above were added at this time.

The mixture was then heated to about 80°C and held at about 80°C for about 5 minutes in order to pasteurize the mixture.

The temperature of the mixture was then lowered to about 60°C and the mixture was homogenized using a two-stage process wherein the pressure during the first stage was in the range 2,000 to 2,400 p.s.i. and in the second stage the pressure was 500 to 600 p.s.i.

After homogenization, the mixture was allowed to cool and then packaged into suitable containers and stored at refrigeration temperatures in the range of about 2° to 8°C.

The spread produced in accordance with this example had the desired qualities of the dairy spread in accordance with this invention.

There is one test which, while not quantifiable, demonstrates one particularly important characteristic of the dairy spreads of the present invention, that is the spreadability at refrigeration temperature. The same test will also demonstrate another characteristic of the dairy spreads of the present invention, which is its ability to maintain its physical integrity, even though it has been kept at room temperature for a period of time up to several hours.

That test is the so-called "warm toast" test. In this test, several slices of ordinary warm toast are prepared from ordinary white sliced bread, and they are taken immediately from the toaster to a plate so that ordinary butter and the reduced-fat dairy spread of the present invention can be spread on the fresh warm toast. As noted, the test may be carried out with various conditions of storage of the butter and dairy spread being tested.

In the first test, the butter and the reduced-fat dairy spread of the present invention are removed from the refrigerator at the same time that the toast is taken from the toaster, to be spread on the toast. The butter is not capable of being spread on the toast; however, the reduced-fat dairy spread of the present invention is easily spreadable on the fresh warm toast.

In another test, the butter and the reduced-fat dairy spread of the present invention have each been removed from the refrigerator and placed in an ambient room temperature of about 23°C for approximately 30 minutes. When those samples are

spread onto warm fresh toast, the butter is quite reasonably spreadable, as is the reduced-fat dairy spread of the present invention.

However, in a third test, the butter and the reduced-fat dairy spread of the present invention have been removed from the refrigerator for approximately two hours before being spread onto fresh warm toast. In this case, the butter tended to be absorbed almost immediately by the toast, so as not to be spreadable. On the other hand, the reduced-fat dairy spread of the present invention remained spreadable, even under these conditions.

Moreover, in one of the most usual purposes of butter, that of being spread on bread products of all sorts, the reduced-fat dairy spreads of the present invention demonstrate a significant improvement over conventional butter in that they are spreadable at refrigeration temperatures. In other words, at typical refrigeration temperatures of, say, about 2°C or 3°C up to about 8°C or 10°C, a reduced-fat dairy spread may be taken directly from the refrigerator and spread on soft bread, as well as on toast, toasted bagels, rolls, buns, and the like.

It should also be noted that, while the present discussion is particularly directed to dairy milk - that is, milk obtained from dairy cattle - the teachings of the present invention may be extended in particular circumstances to include other similar milk products such as goat milk, buffalo milk, or the like.

It will be understood that, although various features of the invention have been described with respect to one or another of the embodiments of the invention, the various features and embodiments of the invention may be combined or used in conjunction with other features and embodiments of the invention as described herein.

Although this disclosure has described certain preferred embodiments of the invention, it is to be understood that the invention is not restricted to these particular embodiments. Rather, the invention includes all embodiments which are functional, chemical or mechanical equivalents of these specific embodiments and features which have been described herein.

WE CLAIM:

1. A dairy spread which is spreadable at refrigeration temperatures comprising:

butterfat in a range of about 20% to 55% by weight of the spread;

water in the range of about 30% to 75% by weight of the spread;

milk solids having binding constituents, wherein the milk solids are in a range of about 5% to 30% by weight of the spread;

wherein the milk solids are dissolved in the water and the binding constituents of the milk solids bind at least some of the water; and

wherein the water is in a continuous phase and the butterfat is in a discontinuous phase suspended in the continuous phase of water.

2. A dairy spread as defined in claim 1 wherein the water is in a range of about 35% to 60% by weight.

3. A dairy spread as defined in claim 1 wherein the water is in a range of about 40% to 50% by weight.

4. A dairy spread as defined in claim 1 wherein the milk solids are in a range of about 5% to 20% by weight.

5. A dairy spread as defined in claim 1 wherein the milk solids are in a range of about 10% to 17% by weight.

6. A dairy spread as defined in claim 1 wherein the butterfat is in a range of about 25% to 45% by weight and the milk solids are in a range of about 5% to 20% by weight.

7. A dairy spread as defined in claim 1 wherein the butterfat is in a range of about 35% to 55% by weight and the milk solids are in a range of about 5% to 20% by weight.

8. A dairy spread as defined in claim 1 wherein the butterfat is in a range of about 35% to 45% by weight and the milk solids are in a range of about 5% to 20% by weight.

9. A dairy spread as defined in claim 1 wherein the butterfat is in a range of about 37% to 43% by weight and the milk solids are in a range of about 5% to 20% by weight.

10. A dairy spread as defined in claim 1 wherein the butterfat is in a range of about 35% to 45% by weight, the water is in the range of about 40% to 50% by weight; and the milk solids are in a range of about 10% to 17% by weight.

11. A dairy spread as defined in claim 1 wherein the butterfat is in a range of about 37% to 43% by weight, the water is in the range of about 40% to 50% by weight; and the milk solids are in a range of about 10% to 17% by weight.

12. A dairy spread as defined in any of claims 1, 10 or 11 wherein no lecithin, emulsifier or stabilizer is additionally added to the spread.

13. A method for producing a dairy spread which is spreadable at refrigeration temperatures, the dairy spread comprising:

butterfat in a range of about 20% to 55% by weight of the spread;

water in a range of about 30% to 75% by weight of the spread;

milk solids having binding constituents, wherein the milk solids are in the range of about 5% to 30% by weight of the spread;

wherein the milk solids are dissolved in water and the binding constituents of the milk solids bind at least some of the water; and

wherein the water is in a continuous phase and the butterfat is in a discontinuous phase suspended in the continuous phase of water;

the method comprising the steps of:

a) providing a quantity of milk and/or cream having butterfat;

b) if the butterfat of the spread is not within the range of 20% to 55% by weight, adjusting the butterfat of the spread by adding butterfat to the milk and/or cream so as to bring the butterfat of the spread to within the range of about 20% to 55% by weight;

c) adding milk solids to the milk and/or cream, either before or after adjusting the butterfat, to form a mixture;

d) heating the mixture at a pasteurization temperature for a pasteurization time; and

e) wherein when the butterfat is present in globules having various sizes, modifying the size of the butterfat globules such that the butterfat globules are of approximate uniform size.

14. A method as defined in claim 13 wherein the water is in a range of about 35% to 60% by weight.

15. A method as defined in claim 13 wherein the water is in a range of about 40% to 50% by weight.

16. A method as defined in claim 13 wherein the milk solids are in a range of about 5% to 20% by weight.

17. A method as defined in claim 13 wherein the milk solids are in a range of about 10% to 17% by weight.

18. A method as defined in claim 13 wherein the butterfat is in a range of about 25% to 45% by weight and the milk solids are in a range of about 5% to 20% by weight.

19. A method as defined in claim 13 wherein the butterfat is in a range of about 35% to 55% by weight and the milk solids are in a range of about 5% to 20% by weight.

20. A method as defined in claim 13 wherein the butterfat is in a range of about 35% to 45% by weight and the milk solids are in a range of about 5% to 20% by weight.

21. A method as defined in claim 13 wherein the butterfat is in a range of about 37% to 43% by weight and the milk solids are in a range of about 5% to 20% by weight.

22. A method as defined in claim 13 wherein the butterfat is in a range of about 35% to 45% by weight, the water is in the range of about 40% to 50% by weight; and the milk solids are in a range of about 10% to 17% by weight.

23. A method as defined in claim 13 wherein the butterfat is in a range of about 37% to 43% by weight, the water is in the range of about 40% to 50% by weight; and the milk solids are in a range of about 10% to 17% by weight.

24. A method as defined in claim 13 wherein no lecithin, emulsifier or stabilizer is additionally added to the spread.

25. A method as defined in claim 13 wherein the quantity of milk and/or cream provided in step (a) is unhomogenized milk and/or unhomogenized cream.

26. A method as defined in claim 13 wherein the milk solids are added to the milk and/or cream when the milk and/or cream is at a temperature in a range from about 2°C to 15°C.

27. A method as defined in claim 26 wherein the mixture is allowed to hydrate at a suitable hydrating temperature before heating the mixture to the pasteurization temperature.

28. A method as defined in claim 13 wherein the mixture is heated to a pasteurization temperature within a range of about 80°C to 90°C and maintained at that temperature for a period of about 25 seconds to 6 hours so as to pasteurize the mixture and so as to permit coagulation of the binding constituents of the milk solids.

29. A method as defined in claim 28 wherein the mixture is heated to a pasteurization temperature of about 80°C for about 5 minutes.

30. A method as defined in claim 13 wherein the modification of the particle size of the butterfat globules takes place when the mixture is at a temperature within a range of about 25°C to 90°C.

31. A method as defined in claim 30 wherein the modification of the particle size of the butterfat globules takes place when the mixture is at a temperature within a range of about 55°C to 65°C.

32. A method as defined in claim 13 wherein the quantity of milk and/or cream provided in step (a) is unhomogenized milk and/or unhomogenized cream;

wherein the milk solids are added to the milk and/or cream when the milk and/or cream is at a temperature in a range from about 2°C to 15°C;

wherein the mixture is allowed to hydrate at a suitable hydrating temperature before heating the mixture to pasteurization temperatures;

wherein the mixture is heated to a pasteurization temperature of about 80°C for about five minutes; and

wherein the modification of the particle size of the butterfat globules takes place when the mixture is at a temperature within a range of about 55°C to 65°C.

33. A method as defined in claim 13 wherein at least part of the milk and/or cream which is provided has been cultured prior to its use.

34. A dairy spread which is spreadable at refrigeration temperatures having butterfat in the range from about 35% to 45% weight, about 40% to 50% by weight of water, about 10% to 17% by weight of milk solids having protein constituents, and zero to trace amounts of each of a butter culture, salt, approved butter colours which are compatible with butter, and zero to trace amounts of lecithin, potassium sorbate, sodium benzoate and an acidifier;

wherein the water is bound by the protein constituents of the milk solids and the water is in a continuous phase; and

wherein the butterfat is in a discontinuous phase in the water.

35. A dairy spread which is spreadable at refrigeration temperatures which has between about 35% to 45% by weight of butterfat, 40% to 50% by weight of water, 10% to 17% by weight of milk solids having protein constituents, and zero to trace amounts of each of a butter culture, salt, approved butter colours which are compatible with butter, and zero to trace amounts of lecithin, potassium sorbate, sodium benzoate and an acidifier;

wherein the water is bound by the protein constituents of the milk solids and the water is in a continuous phase; and

wherein the butterfat is in a discontinuous phase in the water;

said method comprising the steps of:

a) selecting a quantity of unhomogenized milk or unhomogenized heavy cream or a mixture thereof;

b) adding butterfat, if necessary, to the unhomogenized milk, unhomogenized cream or mixture thereof so as to bring the butterfat content of the spread to about 40% plus or minus 5% by weight thereof;

c) adding milk solids to the unhomogenized milk,

unhomogenized cream or a mixture thereof;

d) adding to the mixture of the milk solids and the unhomogenized milk, unhomogenized cream or mixture thereof, if desired, the trace amounts of a butter culture, salt, approved butter colours, lecithin, potassium sorbate, sodium benzoate and an acidifier;

e) pasteurizing the mixture; and

f) homogenizing the mixture.

36. A reduced-fat dairy spread which is spreadable at refrigeration temperatures, and which has an appearance, flavour, consistency, rheology, and mouth-feel similar to butter;

wherein said dairy spread has a formulation comprising 20% to 43% by weight of butterfat, 30% to 75% by weight of water, 5% to 30% by weight of milk solids having protein constituents thereof, and zero to trace amounts of each of a butter culture, salt, and approved butter colours which are compatible with butter, and zero to trace amounts of lecithin, potassium sorbate, sodium benzoate, and an acidifier;

wherein the water content of said dairy spread is bound by the protein constituents of said milk solids, in a continuous phase dispersion thereof; and

wherein said butterfat is in a discontinuous phase suspended in said continuous phase dispersion.

37. A method for production of a reduced-fat dairy spread which is spreadable at refrigeration temperatures, and which has a formulation comprising 20% to 43% by weight of butterfat, 30% to 75% by weight of water, 5% to 30% by weight of milk solids having protein constituents thereof, and zero to trace amounts of each of a butter culture, salt, and approved butter colours which are compatible with butter, and zero to trace amounts of lecithin, potassium sorbate, sodium benzoate, and an acidifier; and

wherein the water content of said reduced-fat dairy spread is bound by the protein constituents of said milk solids in a continuous phase dispersion thereof, and said butterfat is in a discontinuous phase suspended in said continuous phase dispersion:

said method comprising the steps of:

a) selecting a quantity of unhomogenized milk, unhomogenized heavy cream, and mixtures thereof, where said selected quantity of unhomogenized milk, unhomogenized heavy cream, or mixture thereof, has a butterfat content of 20% to 40%, $\pm$ 3%, by weight thereof;

b) adding butterfat, if necessary, to said selected quantity of unhomogenized milk, unhomogenized heavy cream, or mixture thereof so as to bring the fat content thereof to a selected butterfat content thereof in the range of 20% to 40%, $\pm$ 3%, by weight thereof;

c) maintaining said unhomogenized milk, unhomogenized heavy cream, or mixture thereof, at a temperature of about 2°C to 10°C, and adding thereto a selected quantity of milk solids so as to bring the milk solids content of the finished product up to 5% to 30% by weight thereof;

d) while maintaining said unhomogenized milk, unhomogenized heavy cream, or mixture thereof, at a temperature of 2°C to 10°C, optionally adding thereto trace amounts of each of a butter culture salt, and approved butter colours which are compatible with butter, and optionally adding thereto trace amounts of lecithin, potassium sorbate, sodium benzoate, and an acidifier;

e) stirring the mixture of unhomogenized milk, unhomogenized heavy cream, or mixture thereof, together with said milk solids and said optional added trace constituents, while maintaining said mixture at a temperature of 2°C to 10°C, until a slurry is developed with said milk solids and said optional added trace constituents being held in suspension in said stirred mixture;

f) heating said stirred mixture to a temperature of 82°C to 90°C, and maintaining the heated mixture at a temperature of 82°C to 90°C for a period of 25 seconds to 6 hours, so as to pasteurize said stirred mixture, and so as to permit coagulation of the protein constituents of said milk solids;

g) homogenizing said heated stirred mixture at a temperature of 25°C to 90°C;

h) transferring the homogenized mixture to a temperature controlled holding tank, and maintaining the temperature thereof at 15°C to 40°C;

i) transferring the homogenized mixture from said holding tank through a heat exchanger to a filling machine, so as to reduce the temperature of said homogenized mixture to 8°C to 30°C;

j) transferring selected quantities of said cooled homogenized mixture to containers therefor, for storage as reduced-fat dairy spread; and

k) storing said reduced-fat dairy spread at temperatures below 8°C.

38. The method of claim 37, wherein the unhomogenized heavy cream which is used in step a) has been cultured prior to its use.

39. A reduced-fat dairy spread which is spreadable at refrigeration temperature, and which has an appearance, flavour, consistency, rheology, and mouth-feel similar to butter;

said dairy spread having a formulation comprising 30% to 43% by weight of butterfat, 35% to 60% by weight of water, 5% to 20% by weight of milk solids having protein constituents thereof, and zero to trace amounts of each of a butter culture, salt, and approved butter colours which are compatible with butter, and zero to trace amounts of lecithin, potassium sorbate, sodium benzoate, and an acidifier;

wherein the water content of said dairy spread is bound by the protein constituents of said milk solids, in a continuous phase dispersion thereof; and

wherein said butterfat is in a discontinuous phase suspended in said continuous phase dispersion.

40. The dairy spread of claim 39, wherein the dairy spread is spreadable at temperatures from about 2°C up to about 30°C.

41. The dairy spread of claim 39, wherein said milk solids are derived from the group consisting of dry skim milk solids, dry buttermilk solids, dry casein solids, dry caseinates, dry whey protein solids, and mixtures thereof.

42. A method for production of a reduced-fat dairy spread which is spreadable at refrigeration temperature, and which has a formulation comprising 30% to 43% by weight of butterfat, 35% to 60% by weight of water, 5% to 20% by weight of milk solids having protein constituents thereof, and zero to trace amounts of each of a butter culture, salt, and approved butter colours which are compatible with butter, and zero to trace amounts of lecithin, potassium sorbate, sodium benzoate, and an acidifier; and

wherein the water content of said reduced-fat dairy spread is bound by the protein constituents of said milk solids in a continuous phrase dispersion thereof, and said butterfat is in a discontinuous phase suspended in said continuous phase dispersion; said method comprising the steps of:

a) selecting a quantity of unhomogenized heavy cream;

b) adding butterfat, if necessary, to said unhomogenized heavy cream so as to bring the fat content thereof up to 40% $\pm$ 3% by weight thereof;

c) maintaining said unhomogenized heavy cream at a temperature of 2°C to 10°C, and adding thereto a selected quantity of milk solids so as to bring the milk solids content of the finished product up to 5% to 20% by weight thereof;

d) while maintaining said unhomogenized heavy cream at a temperature of 2°C to 10°C, optionally adding thereto trace amounts of each of a butter culture, salt, and approved butter colours which are compatible with butter, and optionally adding thereto trace amounts of lecithin, potassium sorbate, sodium benzoate, and an acidifier;

e) stirring the mixture of unhomogenized heavy cream, milk solids and said optional added trace constituents, while maintaining said mixture at a temperature of 2°C to 10°C, until a slurry is developed with said milk solids and said optional added trace constituents being held in suspension in said stirred mixture;

f) heating said stirred mixture to a temperature of 82°C to 90°C, and maintaining the heated mixture at a temperature of 82°C to 90°C for a period of 25 seconds to 6 hours, so as to pasteurize said stirred mixture, and so as to permit coagulation of the protein constituents of said milk solids;

g) homogenizing said heated stirred mixture at a temperature of 25°C to 90°C;

h) transferring the homogenized mixture to a temperature controlled holding tank, and maintaining the temperature thereof at 15°C to 40°C;

i) transferring the homogenized mixture from said holding tank through a heat exchanger to a filling machine, so as to reduce the temperature of said homogenized mixture to 8°C to 30°C;

j) transferring selected quantities of said cooled homogenized mixture to containers therefor, for storage as reduced-fat dairy spread; and

k) storing said reduced-fat dairy spread at temperatures below 8°C.

43. The method of claim 42, wherein milk solids are derived from the group consisting of dry skim milk solids, dry buttermilk solids, dry casein solids, dry caseinates, dry whey protein solids, and mixtures thereof.

44. The method of claim 42, wherein said heat exchanger is a swept surface heat exchanger.

45. The method of claim 42, wherein the unhomogenized heavy cream which is used in step a) has been cultured, prior to its use.

46. A reduced-fat dairy spread which is spreadable at refrigeration temperature, and which has an appearance, flavour, consistency, rheology, and mouth-feel similar to butter;

said dairy spread having a formulation comprising 20% to 30% by weight of butterfat, 35% to 75% by weight of water, 5% to 30% by weight of milk solids having

protein constituents thereof, and zero to trace amounts of each of a butter culture, salt, and approved butter colours which are compatible with butter, and zero to trace amounts of lecithin, potassium sorbate, sodium benzoate, and an acidifier;

wherein the water content of said dairy spread is bound by the protein constituents of said milk solids, in a continuous phase dispersion thereof; and

wherein said butterfat is in a discontinuous phase suspended in said continuous phase dispersion.

47. The dairy spread of claim 46, wherein the dairy spread is spreadable at temperatures from about 2°C up to about 30°C.

48. The dairy spread of claim 46, wherein said milk solids are derived from the group consisting of dry skim milk solids, dry buttermilk solids, dry casein solids, dry caseinates, dry whey protein solids, and mixtures thereof.

49. A method for production of a reduced-fat dairy spread which is spreadable at refrigeration temperature, and which has a formulation comprising 20% to 30% by weight of butterfat, 35% to 75% by weight of water, 5% to 30% by weight of milk solids having protein constituents thereof, and zero to trace amounts of each of a butter culture, salt, and approved butter colours which are compatible with butter, and zero to trace amounts of lecithin, potassium sorbate, sodium benzoate, and an acidifier; and

wherein the water content of said reduced-fat dairy spread is bound by the protein constituents of said milk solids in a continuous phase dispersion thereof, and said butterfat is in a discontinuous phase suspended in said continuous phase dispersion; method comprising the steps of:

a) selecting a quantity of unhomogenized milk having a selected butterfat content of 20% to 30% by weight thereof;

b) whenever the butterfat content of said unhomogenized milk is below said selected butterfat content, adding butterfat to said homogenized milk so as to bring the butterfat content thereof up to said selected butterfat content;

c) maintaining said unhomogenized milk at a temperature of 2°C to 10°C, and adding thereto a selected quantity of milk solids so as to bring the milk solids content of the finished product up to 5% to 30% by weight thereof;

d) while maintaining said unhomogenized milk at a temperature of 2°C to 10°C, optionally adding thereto trace amounts of each of a butter culture, salt, and approved butter colours which are compatible with butter, and optionally adding thereto trace amounts of lecithin, potassium sorbate, sodium benzoate, and an acidifier;

e) stirring the mixture of unhomogenized milk, milk solids and said optional added trace constituents, while maintaining said mixture at a temperature of 2°C to 10°C, until a slurry is developed with said milk solids and said optional added trace constituents being held in suspension in said stirred mixture;

f) heating said stirred mixture to a temperature of 82°C to 90°C, and maintaining the heated mixture at a temperature of 82°C to 90°C for a period of 25 seconds to 6 hours, so as to pasteurize said stirred mixture, and so as to permit coagulation of the protein constituents of said milk solids;

g) homogenizing said heated stirred mixture at a temperature of 25°C to 90°C;

h) transferring the homogenized mixture to a temperature controlled holding tank, and maintaining the temperature thereof at 15°C to 40°C;

i) transferring the homogenized mixture from said holding tank through a heat exchanger to a filling machine, so as to reduce the temperature of said homogenized mixture to 8°C to 30°C;

j) transferring selected quantities of said cooled homogenized mixture to containers therefor, for storage as reduced-fat dairy spread; and

k) storing said reduced-fat dairy spread at temperatures below 8°C.

50. The method of claim 49, wherein said milk solids are derived from the group consisting of dry skim milk solids, dry buttermilk solids, dry casein solids, dry caseinates, dry whey protein solids, and mixtures thereof.

51. The method of claim 49, wherein said heat exchanger is a swept surface heat exchanger.

52. The method of claim 49, wherein the unhomogenized heavy cream which is used in step a) has been cultured prior to its use.

53. A dairy spread which is spreadable at refrigeration temperatures comprising:

butterfat in a range of about 20% to 55% by weight of the spread;

water in the range of about 30% to 75% by weight of the spread, wherein the water is a water phase of cream;

milk solids having binding constituents, wherein the milk solids are in a range of about 5% to 30% by weight of the spread;

wherein the milk solids are dissolved in the water and the binding constituents of the milk solids bind at least some of the water; and

wherein the water is in a continuous phase and the butterfat is in a discontinuous phase suspended in the continuous phase of water.

INTERNATIONAL SEARCH REPORT

Inter onal Application No
PCT/CA 98/00732

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A23C9/15 A23C15/16

According to International Patent Classification(IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A23C

Documentation searched other than minimumdocumentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 340 857 A (COÖPERATIEVE CONDENSFABRIEK FRIESLAND) 8 November 1989 see claim 1; example 1	1-4,6-9, 13-16, 18-21, 25,26, 28,30, 33,36, 39-41, 46-48
X	EP 0 018 604 A (BENCKISER-KNAPSACK) 12 November 1980 see claim 1; examples 3-5	1-4,6-8, 36,39,40

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of theinternational search	Date of mailing of the international search report
23 October 1998	12/11/1998

Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

Int. ional Application No
PCT/CA 98/00732

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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X	J. TOBIAS: "Observation on low fat dairy spreads" JOURNAL OF DAIRY SCIENCE, vol. 41, 1958, pages 1117-1120, XP002081961 CHAPAIGN, ILLINOIS US see page 1118 - page 1120, column 1 ---	1-4,6-9, 12-16, 18-21, 24,25, 30,33, 36,39,40
X	WO 83 00005 A (ALFA-LAVAL) 6 January 1983 see claims 1,2; example ---	1-4,6-9, 12,36, 39,40
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X	DE 19 17 492 A (HALL SANDFORT) 27 November 1969 see page 12 - page 15; claims 1-4 ---	1,2,4-6, 13,14, 16-18, 25,28, 30,53
X	FR 2 014 742 A (UNILEVER) 17 April 1970 see example 4 ---	1-11
X	SEAS S W ET AL: "DEVELOPMENT OF CHEESE-FLAVORED DAIRY SPREADS WITH CONTROLLED FAT CONTENT" FOOD PRODUCT DEVELOPMENT, vol. 9, no. 9, November 1975, page 68, 70, 74 XP002017463 see page 68; tables I,II ---	1-25,30, 53
X	US 2 224 720 A (T. BUTTERWORTH) 10 December 1940 see the whole document ---	1-6, 12-18, 24-28,53
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Inte onal Application No
PCT/CA 98/00732

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

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